



## RTU Course "Transmission Media"

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**General data**

|   |   |
|---|---|
| Code  | RDE302  |
| Course title  | Transmission Media  |
| Course status in the programme  | Compulsory/Courses of Limited Choice  |
| Responsible instructor  | Ģirts Ivanovs   |
| Academic staff  | Vjačeslavs Bobrovs<br>Andis Supe<br>Jurgis Poriņš   |
| Volume of the course: parts and credits points                        | 2 parts, 6.0 Credit Points, 9.0 ECTS credits  |
| Language of instruction   | LV, EN  |
| Annotation  | The study course is intended for the study of the basic knowledge (key terms, operating principles, typical applications) related to telecommunications cables systems and their applications. The main topics of the study course: communication lines' structures, classification of cables, insulation materials, protective coatings, electromagnetic processes in a waveguide (symmetric and coaxial cable), cable structures optimization, electromagnetic compatibility, mutual interferences (normalization and protection), shielding theory, corrosion, cable line design, construction, and operation. The study course includes both the communication line theory and practical measurements in the student laboratory. International standards related to the applications of communication lines are also addressed. Students are prepared for both practical works on communication lines and further studies in the telecommunications master programme.   |
| Goals and objectives of the course in terms of competences and skills | The aim of the study course is to provide theoretical knowledge about communications lines and to develop practical skills in the calculations of cable line parameters.<br>The tasks of the study course:<br>*to introduce the terminology related to the study course;<br>*to teach to recognize telecommunications cables according to their design characteristics and typical parameters;<br>*to provide knowledge about the physical principles of how electrical signals are propagating in symmetric and coaxial cable lines, including definitions of primary and secondary electrical parameters;<br>*to teach to use of power and attenuation logarithmic units;<br>*to promote the understanding of the most commonly used communications cables' measurements, which include time domain reflectometry and assessment of mutual interference impact on symmetric lines;<br>*to develop skills on communication line protection techniques, including shielding;<br>*to provide knowledge about the general principles and technical solutions for the construction of communication lines;<br>*to promote independently communications cable's calculations tasks. |
| Structure and tasks of independent studies                            | Independent work is organized in the form of individual study of lectures' materials and literature, and solving practical tasks. Learning theoretical background for each laboratory work, processing the results of laboratory works, and completing reports. Preparation and defence of the study course project.  |
| Recommended literature  | Obligātā/Obligatory:<br>1. В. А. Андреев. Направляющие системы электросвязи. Москва. 2009. 412 с. (Mācību līdzeklis augstskolām)<br>2. John R. Vacca. Cabling handbook. 2nd ed. Prentice Hall PTR, 2001. 620 p. (ISBN 0-13-088317-4)<br>3. Laboratorijas darbu apraksti. RTU, TI, 2010. 25 lpp.<br>4. Ģ. Ivanovs. Izdales materiāli un kursa projekts sakaru līnijās. RTU TI, 2010. 89 lpp.<br>Papildus/Additional:<br>1. John Crisp. Introduction to Copper Cabling. Application for telecommunications, data communications and networking. Oxford, 2006. 211 p. (ISBN 0 7506 5555 0)<br>2. Richard E. Matick "Transmission Lines for Digital and Communication Networks: An Introduction to Transmission Lines, High-frequency and High-speed Pulse Characteristics and Applications", Wiley-IEEE Press, 2000, 388p.<br>Kursa apguvē var izmantot arī kabeļu ražotāju rokasgrāmatas un dažādus interneta resursus./ Different cable manufacturers' handbooks and other Internet resources can be used to study the course topics.  |
| Course prerequisites  | Necessary knowledge in the electrical circuit theory and measurements, as well as knowledge of measurement errors, confidence intervals, and measurement uncertainty in the assessment of mathematics and physics at bachelor study course level.   |

**Course contents**

| Content  | Full- and part-time intramural studies |             | Part time extramural studies |             |
|--|--|-------------|------------------------------|-------------|
|  | Contact Hours                          | Indep. work | Contact Hours                | Indep. work |
| Introduction. The role of cables lines in communications systems: a short history of the development of communication cables, the content of the study course and programme. | 4                                      | 4           | 0                            | 0           |

|   |            |            |          |          |
|---|------------|------------|----------|----------|
| Communication line constructions and their classification, typical characteristic curves of cables parameters, metals and dielectric materials used in the manufacturing of cables. | 12         | 12         | 0        | 0        |
| Quasi-static processes in communication lines, long-line primary and secondary parameters and their characterising equations, electric circuits impedance matching.                 | 14         | 14         | 0        | 0        |
| The basis of communications lines electrostatics, electromagnetic field theory in communications cables, solutions of Maxwell's equation in a cylindrical coordinate system.        | 10         | 10         | 0        | 0        |
| Theory of mutual interference effects in communications lines, problems of electromagnetic compatibility in communications lines.   | 18         | 18         | 0        | 0        |
| Communications cables shielding, shielding principles for a wide frequency range, electrical and magnetic field screening.  | 8          | 8          | 0        | 0        |
| Protection of communications lines against external electromagnetic influences, causes of influences and parameters to describe them.   | 8          | 8          | 0        | 0        |
| Types and causes of cable line corrosion (soil corrosion, electrical corrosion).  | 6          | 6          | 0        | 0        |
| Laboratory works.   | 20         | 20         | 0        | 0        |
| Course project.   | 20         | 20         | 0        | 0        |
| <b>Total:</b>   | <b>120</b> | <b>120</b> | <b>0</b> | <b>0</b> |

### ***Learning outcomes and assessment***

| Learning outcomes  | Assessment methods   |
|--|--|
| Is able to navigate independently in the academic and scientific literature related to the telecommunications lines sector. Shall be familiar with the principles of the construction and functioning of communications lines. | Tests, exam.<br>Competence in cabled communications systems and their use in telecommunications networks.  |
| Is familiar with the advantages and disadvantages of different constructions cables. Has competence in various communications systems-related areas.   | Tests, exam.<br>Knowledge of cable applications in different communications systems technologies, including wireless transmission systems.       |
| Is able to solve calculations tasks using the acquired knowledge.  | Tests, laboratory works, study course project, exam.   |
| Is able to perform independently communications lines measurements and identify potential damage to the cable.   | Laboratory works, exam.<br>Capable of performing experiments independently — measurements of cable parameters and processing of results obtained |

### ***Evaluation criteria of study results***

| Criterion            | %          |
|----------------------|------------|
| Tests                | 10         |
| Laboratory works     | 20         |
| Study course project | 20         |
| Exams                | 50         |
| <b>Total:</b>        | <b>100</b> |

### ***Study subject structure***

| Part | CP  | Hours per Week |           |      | Tests |      |      |
|------|-----|----------------|-----------|------|-------|------|------|
|      |     | Lectures       | Practical | Lab. | Test  | Exam | Work |
| 1.   | 2.0 | 3.0            | 0.0       | 0.0  |       | *    |      |
| 2.   | 4.0 | 1.0            | 0.5       | 1.5  |       | *    |      |